

PATENT SPECIFICATION

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(21) Application No. 54809/74 (22) Filed 18 Dec. 1974

(23) Complete Specification filed 11 Dec. 1975

(44) Complete Specification published 29 June 1977

(51) INT. CL.² F16D 3/41

(52) Index at acceptance

F2U 524 526 572 580

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(54) IMPROVEMENTS RELATING TO HOOKE'S
TYPE UNIVERSAL JOINTS

(71) We, GKN TRANSMISSIONS LIMITED, a British Company of, Chester Road, Erdington, Birmingham B24 0RB, in the County of Warwickshire, do hereby declare the invention, for which we pray that a Patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

10 This invention relates to Hooke's type universal joints (hereinafter referred to as being of the kind specified) each such joint including a cross piece having radially projecting stubs spaced apart angularly about
15 a longitudinal reference axis of the joint and serving to establish connection between yoke pieces about two pivotal axes which are mutually perpendicular to each other and to the reference axis, connection
20 between each stub and a respective arm of the yoke pieces being through the intermediary of a bearing comprising a cup enveloping the end portion of the stub and located in a seating in the arm of the yoke
25 piece, such cup containing a bearing element for taking loads radial to the stub, such as a roller assembly (herein called the radial bearing) and a bearing for taking loads exerted axially of the stub and interposed between the end of the stub and the closed end of the cup (and herein referred to as the thrust bearing).

30 Thrust bearings which have been commonly employed in universal joints of the kind specified have comprised washers made of a suitable bearing material, in some cases metal and in some cases non-metallic material being employed.

40 It is usual for the washer concerned to be of a diameter which is smaller than the internal diameter of the cup so as to leave an annular space clear between the edge of the washer and the side wall of the cup in axial alignment with the adjacent end of the
45 radial bearing. When the radial bearing is in the form of an assembly of rollers this

prevents contact between these rollers and the washer which forms the thrust bearing which could cause damage to the thrust bearing and possibly malfunctioning of the
50 rollers. Further, the presence of the thrust bearing ensures maintenance of an axially spaced relation between the end wall of the cup and the radial bearing.

In order to ensure maintenance of this
55 positional relationship between the thrust bearing, e.g. washer, stub, cup and radial bearing, it has previously been proposed to provide a recess in the end of the stub, such recess being of shallow cylindrical
60 form having a diameter slightly less than that of the stub but sufficient to contain the washer acting as the thrust bearing, the thickness of the latter being sufficient to allow it to protrude endwise with respect
65 to the rim or unrecessed part of the stub which forms the boundary to the locating recess.

Since thrust bearings in the form of washers are generally made relatively thin
70 compared with the overall axial dimension of the cup, it is possible, even when a locating recess is provided in the stub as above mentioned, for the component parts concerned to be misassembled so that the
75 washer is eccentric to the axis of the stub itself and thus it is then not only not seated properly in the recess but also has a portion which is in axial alignment with part of the radial bearing thereby leading to the dis-
80 advantageous effects already mentioned.

The object of the present invention is to avoid or reduce the occurrence of such circumstances.

According to the invention a universal
85 joint of the kind specified is provided wherein each stub and its associated thrust bearing have cooperative formations providing for radial location of the thrust bearing in its proper position, these formations
90 being of such form that for all radial displacements of the thrust bearing from its

proper position within its cup before axial assembly of the stub into the cup, the formations, by their co-operation during axial assembly of the stub into the cup, bring the thrust bearing into its proper position.

Thus, in a preferred arrangement, one of the cooperative formations comprises a projection which is convergent in a direction from its base towards its tip or outer end along the axis of the stub, and the other cooperative formation is a recess having a divergent taper in a direction from its base or inner end towards its mouth, the dimensions of the projection and recess being such that the projection must enter at least partially into the recess even when the thrust bearing has the maximum eccentricity with respect to the stub permitted by the internal dimensions of the cup.

Thus when the stub is moved relatively to the cup fully into the latter, the thrust bearing is automatically moved radially into its proper position, e.g. coaxial with the stub, by cooperation of the convergent and divergent surfaces of the projection and recess.

It is preferred that the thrust bearing be in the form of a washer having an outer annular portion centrally of which the washer incorporates said projection whilst the recess is formed in the end face of the stub. The projection may be of conical form and the recess may be of conical form or may be such as to incorporate a frusto-conical portion adjacent to the mouth of the recess. The apex angle of the conical projection and the apex angle of the conical recess, or the frusto-conical portion of the recess, would be selected to ensure that when the projection and recess are in contact with each other by way of their tapering surfaces, forces exerted axially of the stub moving the projection relatively more deeply into the recess overcome any frictional resistance to lateral movement of the thrust bearing and ensure that this becomes centred or located in its proper position when the conical projection has been moved fully into the recess.

A further feature of the invention is that the form and dimensions of the cooperative formations are such that in the event of the thrust bearing being assembled into the cup with the wrong face of the thrust bearing presented towards the end wall of the cup, it will then form an obstruction preventing the stub being assembled fully into the cup to an extent which will be immediately apparent to the person effecting the assembly. In this way incorrect assembly arising merely by use of a relatively thin washer is avoided.

The invention will now be described, by way of example, with reference to the accompanying drawings wherein:—

FIGURE 1 is a view in side elevation and in diametral cross-section showing a fragment of a Hooke's joint of the kind specified, namely a stub and associated bearing cup incorporating one embodiment in accordance with the present invention, the parts being shown in the fully assembled correct position.

FIGURE 2 is a view similar to Figure 1 showing the position occupied by the parts during an attempt at incorrect assembly;

FIGURE 3 is a view similar to Figure 1 showing a possible displacement of the thrust bearing from its proper position at the beginning of assembly;

Referring firstly to Figure 1, it will be understood that the parts of the Hooke's joint not illustrated may be of any conventional form and may comprise a cross piece having four radially projecting stubs arranged with their axes at right angles to each other and at right angles to the reference axis of the joint as a whole, i.e. the axis about which the yoke pieces rotate when they are in axial alignment with each other. These yoke pieces each have a pair of arms joined by a base or connecting portion which is connected, or adapted for connection, to a shaft, and each arm has an aperture in which is received the bearing cup 10 of a bearing 11 which serves as the means for rotatably connecting each stub to an associated one of the arms.

The cup may be of generally cylindrical form having a cylindrical side wall 12 integral with an end wall 13. As shown the side wall may be recessed internally to provide an annular clearance space 14 and the end wall may be likewise recessed to provide an annular clearance space 15 adjacent to the inner ends of rollers 16 which collectively form the radial bearing. Such rollers may be spaced apart angularly from each other and mounted in a cage element (not shown).

For the purpose of taking axially directed or thrust loads, a thrust bearing is provided in the form of a washer having an outer annular portion 16a, the external diameter of which is slightly less than the external diameter of the adjacent end portion 17 of the stub 18. Integral with said annular portion 16a is a conical projection 19. The projection 19 may have a frusto-conical wall 20 integrally connected to the annular portion 16a at the larger diameter end of the former and reinforced internally by webs 21 collectively of cruciform form integral with the wall 20 and projecting through the opening at the smaller diameter end thereof to form a cruciform termination 22.

The end portion 17 of the stub 18 is formed with a recess 23 having, adjacent to

the open end or mouth thereof, an internal frusto-conical surface 24.

The diameter of the larger end of the projection 19 and the diameter of the larger end of the frusto-conical surface 24 are such that, even though the thrust bearing may be displaced radially from its proper position to one having maximum eccentricity with respect to the axis 25 of the stub, as illustrated in Figure 3, the cruciform termination 22 will overlap radially with the frusto-conical surface 24 to some extent so that, upon relative axial movement of the stub more deeply into the bearing cup 10, the tapering surfaces of the projection 19 and the frusto-conical surface 24 of the recess come into contact with each other. Further, the apex angle of the projection 19 and the apex angle of the frusto-conical surfaces 24 are made of a sufficiently low value (e.g. approximately 81°) to ensure that the projection and the surface 24 will cooperate camwise to overcome any frictional resistance between the annular portion 16a and the inner surface of the end wall 13 of the cup during assembly and move the thrust bearing into its proper (coaxial) position as shown in Figure 1.

Whilst the thrust bearing may be made of various materials a preferred material is a non-metallic plastics material such as Nylatron GS (Registered Trade Mark). Such material may be loaded with a lubricant such as molybdenum disulphide.

Further, it will be noted from Figure 2 that if an attempt at incorrect assembly occurs by placing the thrust bearing in the cup with the wrong face presented towards the internal face of the end wall 13, engagement of the annular portion 16a with the end portion 17 of the stub and contact between the cruciform tip 22 and the end wall 13 of the cup will prevent the stub being entered fully into the cup 10 and a degree of projection of the stub will be such as to be immediately apparent to the person effecting the assembly, e.g. the stub can be inserted into the cup only for about half the depth of the latter.

WHAT WE CLAIM IS:—

1. A universal joint of the kind specified wherein each stub and its associated thrust bearing have cooperative formations providing for radial location of the thrust bearing in its proper position, these formations being of such form that for all radial displacements of the thrust bearing from its proper position within its cup before axial assembly of the stub into the cup the formations, by their cooperation during axial assembly of the stub into the cup, bring the thrust bearing into its proper position.

2. A universal joint according to claim 1 wherein one of the cooperative formations comprises a projection which is convergent

in a direction from its base towards its tip or outer end along the axis of the stub and the other cooperative formation is a recess having a divergent taper in a direction from its base or inner end towards its mouth, the dimensions of the projection and recess being such that the projection must enter at least partially into the recess even when the thrust bearing has the maximum eccentricity which respect to the stub permitted by the internal dimensions of the cup.

3. A universal joint according to claim 2 wherein the thrust bearing comprises a washer having an outer annular portion centrally of which the washer incorporates said projection, and the recess is formed in the end face of the stub.

4. A universal joint according to claim 3 wherein the projection is of conical form and the recess is of conical form or incorporates a frusto-conical portion adjacent to its mouth.

5. A universal joint according to claim 4 wherein the apex angle of the conical projection and the apex angle of the conical recess or of the frusto-conical portion of the recess are selected so that when the projection and recess are in contact with each other by way of their tapering surfaces forces exerted axially of the stub moving the projection relatively more deeply into the recess overcome any frictional resistance to lateral movement of the thrust bearing to ensure that this becomes properly located when the conical projection has been moved fully into the recess.

6. A universal joint according to claim 5 wherein the apex angle of the conical projection is approximately 81° .

7. A universal joint according to any one of the preceding claims wherein the form and dimensions of the cooperative formations are such that in the event of the thrust bearing being assembled into the cup with the wrong face of the thrust bearing presented towards the end wall of the cup, it will form an obstruction preventing the stub being assembled fully into the cup to an appreciable extent.

8. A universal joint according to any one of the preceding claims wherein the thrust bearing is made of a plastics material.

9. A universal joint substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

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COMPLETE SPECIFICATION

1 SHEET

*This drawing is a reproduction of
the Original on a reduced scale*

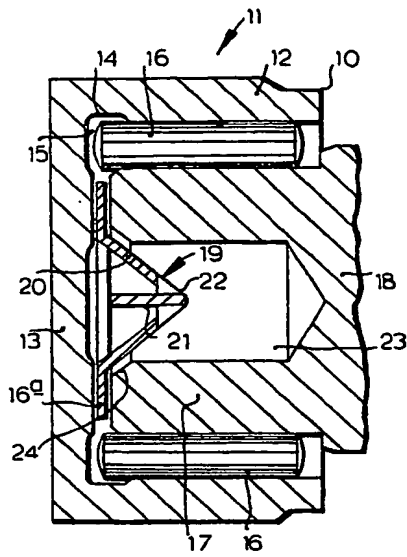


FIG. 1

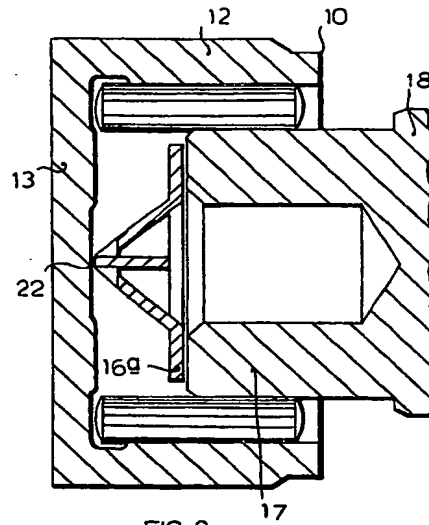


FIG. 2

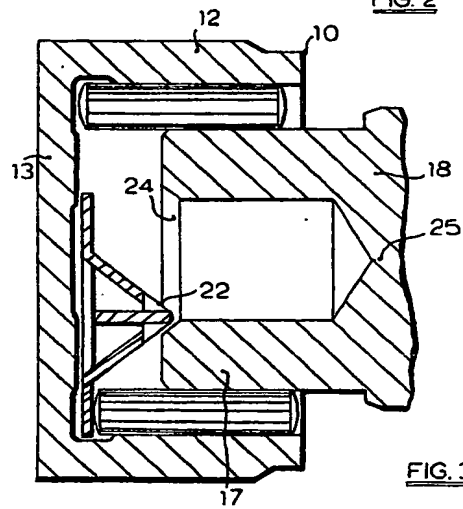


FIG. 3

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